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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/031,454	01/22/2002	Kimio Akiyama	Q68004	6920

7590 10/03/2003

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2100 Pennsylvania Avenue NW
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EXAMINER	
YAMNITZKY, MARIE ROSE	

ART UNIT	PAPER NUMBER
1774	

DATE MAILED: 10/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/031,454	AKIYAMA ET AL.	
	Examiner	Art Unit	
	Marie R. Yamnitzky	1774	

-- The MAILING DATE of this communication appears on the cov r sh et with th correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 January 2002 and 18 March 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

1. The disclosure is objected to because of the following informalities: Clarification is needed with respect to "extra number" as recited at page 2, line 9.

Appropriate correction is required.

2. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a light-emitting material or electroluminescent device comprising at least two organic compounds having the relationship between triplet and singlet states set forth in the present claims wherein the first organic compound is $Ir(ppy)_3$ and the second organic compound is Rhodamine 101 or Nile Red, does not reasonably provide enablement for a light-emitting material or electroluminescent device comprising at least two organic compounds defined solely by the relationship between triplet and singlet states as set forth in the present claims, or defined by the relationship between triplet and singlet states as set forth in the present claims wherein the first compound is generically limited to a transition metal complex or a rare earth metal complex or the second compound is generically limited by the requirement that the emission from the second compound be fluorescence. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

Given the myriad of organic compounds that can be used as light-emitting materials in organic electroluminescent devices, undue experimentation would be required by a person skilled in the art in order to determine the full scope of combinations of compounds meeting the limitations of the present claims.

Insufficient guidance is provided in the specification to determine the full scope of combinations of first and second compounds meeting the limitations of the present claims. The present specification provides only two specific examples of combinations meeting the limitations of the first and second compounds, with both combinations utilizing the same compound for the first compound.

Data regarding the energy levels of excited triplet and singlet states, particularly excited triplet states, of the numerous organic compounds that can potentially be used in the light-emitting layer of the present claims do not appear to be readily available such as through text books or other publications. Accordingly, one would have to perform tests on numerous organic compounds in order to determine what combinations of compounds meet the energy level relationship required by the present claims. One would have to determine the lowest excited triplet and singlet states of two compounds in order to determine whether the energy level of the lowest excited triplet state of one of the compounds is higher than the energy level of the lowest excited singlet state of the other compound. Upon determining that a first compound has a lowest excited triplet state having an energy level higher than the energy level of the lowest excited singlet state of the second compound, one would then have to determine the energy levels of excited triplet states of the second compound other than the lowest excited triplet state of the second compound in order to determine whether the second compound possessed an excited triplet state with an energy level between the lowest excited triplet state of the first compound and the lowest excited triplet state of the second compound. In *Appl. Phys. Lett.* 75(1), 1999, pp. 4-6 (cited by applicants), Baldo et al. state that triplet energy levels "are

frequently unknown and, moreover, are difficult to quantify" (full paragraph, second column, p. 4). Further, based on the article by Kobayashi et al. in *Chemical Physics*, Vol. 27, 1978, pp. 399-407 (cited by applicants), the relationship between the lowest excited singlet state of a compound and the same compound's excited triplet states other than the lowest excited triplet state is not even necessarily a constant. In the paragraph bridging the two columns on page 399, Kobayashi et al. reference an earlier work as showing that the relationship between the second excited triplet state and the lowest excited singlet state of anthracene differs depending upon the conditions under which these excited states are measured.

3. Claims 3, 4, 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 3 and 4 are confusing in reciting "a light-emitting layer as claimed in claim 1". Claim 1 is drawn to an electroluminescent device, not to a light-emitting layer per se. The examiner suggests inserting --as claimed in claim 1-- after "device" in line 1 and changing "a light-emitting layer as claimed in claim 1" to --the light-emitting layer-- or --said light-emitting layer-- in each of claims 3 and 4.

Claims 13 and 14 are confusing in reciting "a light-emitting layer as claimed in claim 2". Claim 2 is drawn to an electroluminescent device, not to a light-emitting layer per se. The examiner suggests inserting --as claimed in claim 2-- after "device" in line 1 and changing "a

light-emitting layer as claimed in claim 2" to --the light-emitting layer-- or --said light-emitting layer-- in each of claims 13 and 14.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. in *Nature*, Vol. 403, pp. 750-753 (February 17, 2000).

Baldo et al. disclose an electroluminescent device comprising, in the order listed, an anode, a hole transport layer, a light-emitting layer, an electron transport layer, and a cathode. The light-emitting layer comprises three organic compounds: CBP, $Ir(ppy)_3$ and DCM2. For example, see Figure 1. The efficiency of the device is improved compared to a device lacking $Ir(ppy)_3$. For example, see Figure 2.

CBP meets the limitations of the third compound required by present claims 2 and 9 and claims dependent therefrom. $Ir(ppy)_3$ and DCM2 meet the limitations of the first compound and second compound, respectively, as required by the present claims with the exception that Baldo et al. do not disclose whether DCM2 has a triplet excited state that has an energy level between the lowest excited triplet state of the host material and the lowest excited singlet state of the fluorescent dye.

Absent a showing of criticality for the requirement that the energy level of one of the excited triplet states of the second compound be between the lowest excited singlet state of the second compound and the lowest excited triplet state of the first compound, it is the examiner's position that one of ordinary skill in the art would have reasonably expected that combinations of phosphorescent compounds such as phosphorescent metal complexes and fluorescent compounds such as fluorescent dyes capable of transferring triplet excitation energy from the phosphorescent compound to the fluorescent compound would provide devices having increased efficiency compared to devices lacking the phosphorescent sensitizer. While the limited data set forth in the present specification demonstrate that the combination of a phosphorescent metal complex with a fluorescent dye provides increased device efficiency compared to a device lacking the phosphorescent metal complex, this is not unexpected in light of Baldo et al. The data in the specification do not demonstrate that a combination of phosphorescent and fluorescent compounds meeting the limitations of the present claims provides superior/unexpected results compared to combinations of phosphorescent and fluorescent compounds wherein the fluorescent compound does not have an excited triplet state with an energy level between the lowest excited singlet state of the fluorescent compound and the lowest excited triplet state of the phosphorescent compound.

6. The references made of record and not relied upon are considered pertinent to applicants' disclosure.

The disclosure of the patent to Forrest et al. (US 6,310,360 B1) is similar to the disclosure of the Baldo article applied above.

Adachi et al. (US 6,458,475 B1) disclose an EL device comprising a host material and a metal complex which exhibits both fluorescence and phosphorescence. Adachi et al. do not disclose whether the metal complex possesses an excited triplet state that has an energy level between the lowest excited triplet state of the host material and the lowest excited singlet state of the fluorescent dye.

The published applications of Fujii (US 2002/0071963 A1) and Sato et al. (US 2002/0125818 A1) do not constitute prior art, but are of interest in disclosing EL devices in which the light-emitting layer comprises a mixture of a metal complex capable of phosphorescent emission and a fluorescent dye. These published applications do not disclose whether the fluoresecent dye possesses an excited triplet state that has an energy level between the lowest excited triplet state of the metal complex and the lowest excited singlet state of the fluorescent dye.

7. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (703) 308-4413. The examiner works a flexible schedule but can generally be reached at this number from 6:30 a.m. to 4:00 p.m. Monday, Tuesday, Thursday and Friday, and every other Wednesday from 6:30 a.m. to 3:00 p.m.

The current fax number for Art Unit 1774 is (703) 872-9306 for all official faxes. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (703) 872-9041.)

MRY
October 01, 2003

Marie R. Yamnitzky

MARIE YAMNITZKY
PRIMARY EXAMINER
1774